REMARKS

With respect to German citation No. DE 197 09 570 A1, listed in paragraph 006 of the specification but not previously listed in the prior Information Disclosure Statement, please note that this reference in the specification contains a typographical error which is corrected in the accompanying substitute specification. That is, this citation should have been listed as DE 197 09 579 A1 which was already properly made of record in this case and considered by the Examiner. As such, a new Information Disclosure Statement is **not** required for this application.

The specification is objected to for the reasons noted in the official action. Due to the number of raised matters, the Applicant is submitting a substitute specification as well as a marked up copy of the original specification indicating the entered amendments. Please enter this substitute specification into the record of this case. The undersigned avers that the enclosed substitute specification does not contain any new matter.

The drawings are objected to for the reasons noted in the official action. All of the raised drawing objections are believed to be overcome by the requested drawing amendments accompanying the attached Submission. If any further amendment to the drawings is believed necessary, the Examiner is invited to contact the undersigned representative of the Applicant to discuss the same. New formal drawings will follow once the Examiner approves the requested drawing amendment(s).

Claims 16-29 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for the reasons noted in the official action. The subject matter of the rejected claims is accordingly rewritten and rewritten as new claims 30 - 48. The presently pending claims are now believed to particularly point out and distinctly claim the subject matter regarded as the invention, thereby overcoming all of the raised § 112, second paragraph, rejections. The entered new claims are directed solely at overcoming the raised indefiniteness rejection(s) and are not directed at distinguishing the present invention from the art of record in this case.

Lastly, claims 16-29 (now new claims 30 - 48) are rejected, under 35 U.S.C. § 103, as being unpatentable over Baker `513. The Applicant acknowledges and respectfully traverses the raised obviousness rejection in view of the following remarks.

Baker `513 relates to a traction wheel unit comprising a motor 10 having a shaft 13 with a drive pinion 16. This drive pinion 16 engages with and drive either gear 17 or 18 which is integral with driven member 19. The driven member 19 drives the axle 20, supporting the wheel and tire which rotate along with the axle 20. In view of the forgoing brief discussion of Baker `513, this reference specifically discloses a single gear set, namely, pinion 16 engages a single ring gear 17 or 18. This is in contrast to the presently claimed invention which all

require, in particular, both first and second reduction gears sets (3, 11) and the disc brake 15 to be located between drive motor (1) and the first and second reduction gears (3, 11).

In order to emphasize the above noted distinctions between the presently claimed invention and the applied art, independent claim 30 of this application now recites the features of:

> "[a] final drive....wherein the reduction gears (3, 11) comprises first and second reduction gear sets (3, 11) which are located adjacent one another, the disk brake (15) is located between the drive motor (1) and the first and second reduction gears (3, 11), and the disk brake (15) forming a stop which limits further insertion of the drive motor (1) within the rim (12)."

In addition, independent claim 46 now recites the features of:

> "[a] final drive....comprising.....a first and second reduction gear set (3, 11); a wheel driven by the first and second gears set (3, 11) rotates about a wheel axis.....the first and second reduction gears sets (3, 11) are located adjacent each other and the disk brake (15) is placed between the drive motor (1) and the first and second reduction gears (3, 11), a length of the drive motor (1) extending within the rim (12) of the wheel is limited by the disk brake (15) and the actuation mechanism (23)."

Lastly, independent claim 48 now recites the features of:

> "[a] final drive... comprising.....a disk brake (15) located within the rim (12) for braking rotation of the vehicle wheel, the disk brake (15) defining a brake plane extending normal to the wheel rotational axis, and the disk brake (15) being actuated by actuation mechanism (23); wherein the reduction gears (3, 11) comprises first and second reduction gear sets (3, 11), and the drive motor (1) is located on one side of the brake plane while the first and second reduction gear sets (3, 11) are located on an opposite side of the brake plane."

Such features are believed to clearly and patentably distinguish the presently claimed invention from all of the art of record, including the applied art.

If any further amendment to this application is believed necessary to advance prosecution and place this case in allowable form, the Examiner is courteously solicited to contact the undersigned representative of the Applicant to discuss the same.

In view of the above amendments and remarks, it is respectfully submitted that all of the raised rejection(s) should be withdrawn at this time. If the Examiner disagrees with the Applicant's view concerning the withdrawal of the outstanding rejection(s) or applicability of the Baker `513 reference, the Applicant respectfully requests the Examiner to indicate the specific passage or passages, or the drawing or drawings, which contain the necessary teaching,

suggestion and/or disclosure required by case law. As such teaching, suggestion and/or disclosure is not present in the applied references, the raised rejection should be withdrawn at this time. Alternatively, if the Examiner is relying on his/her expertise in this field, the Applicant respectfully requests the Examiner to enter an affidavit substantiating the Examiner's position so that suitable contradictory evidence can be entered in this case by the Applicant.

In view of the foregoing, it is respectfully submitted that the raised rejection(s) should be withdrawn and this application is now placed in a condition for allowance. Action to that end, in the form of an early Notice of Allowance, is courteously solicited by the Applicant at this time.

The Applicant respectfully requests that any outstanding objection(s) or requirement(s), as to the form of this application, be held in abeyance until allowable subject matter is indicated for this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

Michael J. Bujold, Reg. No. 32,018
Customer No. 020210
Davis & Bujold, P.L.L.C.
Fourth Floor
500 North Commercial Street
Manchester NH 03101-1151
Telephone 603-624-9220
Facsimile 603-624-9229
E-mail: patent@davisandbujold.com

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service, with sufficient postage, as First Class Mail in an envelope addressed to: Director of the United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. September 19, 2003 .

By: _____

Print Name: Michael J. Bujold

[001] FINAL DRIVE FOR DRIVING A VEHICLE WHEEL

This application is a national stage completion of PCT/EP00/09067 filed September 16, 2000 which claims priority from German Application Serial No. 199 45 345.4 filed September 22, 1999.

[002] FIELD OF THE INVENTION

[003] The invention relates to a final drive of a vehicle wheel.

[004] BACKGROUND OF THE INVENTION

[005] Final drives for driving a vehicle wheel are mainly used in low-platform buses where each driven wheel of the vehicle has its own drive motor. To obtain a sufficient rear width it is needed to keep as low as possible the axial expansion of the final drive.

[006] ~~In~~ DE 197 09 57~~0~~9 A1 has ~~been~~ disclosed an electric single final drive having several motors in which the several motors are not disposed coaxially to the wheel axle ~~and v~~. Via a first reduction gear drive and a second reduction gear, the output of ~~which~~the motors acts upon the drive wheel. ~~B~~A wheel bearing is situated between the first reduction step and the second reduction step ~~a wheel bearing is situated~~, the same as a brake disk which is ~~located~~ additionally located within the extension of the wheel rim of a twin-tire drive wheel. ~~By~~ With the wheel bearing being disposed between and separating both reduction gears ~~being disposed separate from each other by the wheel bearing thereoccurs~~ there occurs, ~~chiefly in helical-cut toothed wheels~~ due to the displacement action of the reduction gear chiefly in helical-cut toothed wheels, a shift of the oil level ~~which~~. This disadvantageously ~~acts upon~~ affects the lubrication of a reduction step. In order to more compactly ~~to~~ design the final drive in its axial extension and make it possible to ~~prepare~~ deliver the required torque, several electrical drive motors have to be used.

[007] The problem on which this invention is based is to provide a final drive for driving a vehicle wheel which is compactly designed in axial extension and in which the brake is situated in a wheel rim, only one drive motor is used for each

final drive, the reduction gear is sufficiently lubricated and that stands out by a good degree of efficiency.

[008]

[009] SUMMARY OF THE INVENTION

[010] According to the invention the final drive can be decelerated via a brake located within the axial extension of a wheel rim~~, it being~~. It is possible that the wheel rim ~~be also a rim for~~ accommodates a single tire and ~~in which~~ the brake is placed between the drive motor and the reduction steps. ~~By~~With the reduction steps being disposed directly adjacent, all the ~~moved~~ moving parts of the toothing can be lubricated by ~~one~~ lubricant which is located within a space common ~~space where~~ with the reduction steps ~~are placed~~. ~~Hereby a uniform temperature level results which b~~ By virtue of the arrangement of the reduction gear upon the ~~wheel~~ outer side of the wheel, heat can satisfactorily radiate ~~heat~~ to the environment, resulting in a uniform temperature level. ~~T~~Since the drive motor is not situated coaxially to the rotational axis of the wheel ~~axle whereby~~, an installation space between the wheel rim and drive motor ~~an installation space~~ results ~~where can be placed~~ and the brake and the actuation mechanism can be placed ~~there of~~in. The wheel bearing is preferably disposed for absorbing the wheel forces radially above the first reduction gear so that the axial installation space needed by the wheel bearing is available to the drive motor. Thereby the drive motor can be designed with a maximum active length preferably similar or equal to the diameter of the air gap without the total length of the final drive being enlarged thus increasing the degree of efficiency of the drive motor. By the wheel bearing being situated in radial direction outside the first reduction step but being located in the radial extension area of the first reduction step, it is possible to connect the wheel hub, one part of the second reduction step and the bearing flange with the wheel bearing to form a compact unit ~~which also has~~. This compact unit does not need to be separated even when disassembling the wheel drive ~~whereby~~ such that during ~~an~~ assembly ~~in case of~~ while servicing the wheel bearing ~~has~~ does not need to be ~~adjusted again~~ readjusted. The second reduction step is preferably designed

as planetary gear wherein the planet carrier of the planetary gear forms the output, the ring gear is connected with the hub carrier which carries the wheel bearing and the inner central wheel forms the input. ~~But i~~ It is also possible to design the ring gear as output. ~~T~~ In this case the inner central wheel is driven by the first reduction step which is preferably designed so that the ring gear forms the output~~;~~ and an input pinion forms the input, which is in intermeshing connection with the ring gear and at least two intermediate wheels, and the carrier which holds the intermediate wheel ~~[[in]]~~ is ~~non-turnably~~ non-rotatablyretained. By the input pinion being in intermeshing connection directly with the ring gear, the drive motor which drives the input pinion can be situated at a maximum distance from the wheel axle with the result of a sufficient installation space for the brake and the actuation mechanism of the brake. ~~By~~ With the input pinion ~~being in~~ having an intermeshing connection with the ring gear and with at least two intermediate wheels, ~~the~~ torque is distributed ~~on~~ from the input pinion at multiple locations with the consequence of an increase in the service life of the input pinion and the first reduction step can ~~thus~~ be more compactly designed ~~whereby~~ by reducing the diameter of the wheel bearing ~~can be reduced~~. ~~By~~ With the housing of the drive motor transmitting the wheel forces and the mounting pad of the drive motor being located in the area of the load active line on a hub carrier ~~which~~, the hub carrier carries the wheel bearing ~~in which~~ where the wheel forces are introduced~~, t~~. The connecting elements of the supporting parts which absorb the wheel forces can be more compactly designed ~~smaller~~ in extension~~-~~, since no additional torque load from a distance to the load active line acts upon the mounting pad and the connecting elements thereof. Hereby the radial extension of the mounting pad of the drive motor housing can be compactly designed ~~so small~~ on the bearing flange such that a sealing element can be placed between the ~~non-turnably situated~~ bearing flange, situated to be non-rotatable and a wheel hub rotating at wheel rotational speed which ~~due to the small radial extension~~ has less peripheral velocities to overcome due to the small radial extension. The housing of the drive motor can either be ~~connected with~~ fixed to an axle bridge or have supporting places on which fastening elements can be situated for fastening the final drive to the vehicle body.

Since the drive motor is located on the ~~wheel~~ inner side of the wheel, the energy can be favorably supplied. ~~Upon the wheel hub f~~ Fins are preferably situated ~~with~~ upon the wheel hub such that upon rotation of the wheel hub ~~set in motion~~ the medium surrounding the wheel hub is circulated so that the brake and the final drive are cooled. ~~T~~A coolant preferably flows through the housing of the drive motor ~~is preferably flowed through by a coolant which~~ thus ~~cools~~ cooling the drive motor and the remaining final drive is also cooled via the mounting pad of the drive motor ~~also cools the remaining final drive~~.

[011] A directly adjacent arrangement of the reduction steps and a brake situated between the reduction steps and the drive motor but within the axial and radial extension of a wheel rim create a final drive for driving a vehicle wheel which stands out by a compact construction, where a drive motor with optimum degree of efficiency can be used and the reduction steps are sufficiently lubricated.

[012] BRIEF DESCRIPTION OF THE DRAWINGS

[013] The invention will now be described, by way of example, with reference to the accompanying drawings in which:

[014] Fig. 1 is a final drive for driving a vehicle with double-shear planet carrier; and

[015] Fig. 2 is a second embodiment of a final drive for driving a vehicle with double-shear planet carrier.

[016] DETAILED DESCRIPTION OF THE INVENTION

[017] The drive motor 1 not coaxially situated relative to the rotational axis of the wheel ~~axle~~ 26 is preferably an electric drive motor but may also be a hydraulic or pneumatic drive motor and it drives an input shaft 2 which preferably ~~passed~~ passes into the housing 4 of the drive motor 1 of a first reduction step 3. The housing 4 of the drive motor is preferably cooled by water and is connected with a hub carrier 5 via connecting elements. The ~~mounting pad 6 of the drive motor 1 on the~~ hub carrier 5 is located in the area of a load active line 7 along the mounting pad 6 of the drive motor 1 where the wheel forces act upon the final drive. The active load line 7 defining the longitudinal center of the tire and wheel. By the mounting pad 6 being situated in the area of the active load line 7, so that none or only small torque loads generated by the vehicle weight act upon the elements which connect the hub carrier 5 with the housing 4 of the drive motor 1. The mounting pad 6 can thus ~~be made~~ have a small ~~in~~ dimension along its radial extension, it being possible upon this diameter to place a sealing element 8 between a wheel hub 9 rotating at the rotational speed of the wheel and the hub carrier 5. Since the dimension of the radial extension of the mounting pad 6 is small the peripheral velocity of the sealing element 8 is also small, which advantageously acts upon the service life~ of the sealing element 8. The wheel hub 9 is connected with the planet carrier 10 which forms the output of a second reduction gear 11 and with a wheel rim 12. A pair of wheel bearing 13 supports the wheel hub 9, the ring gear 14, the second reduction step 11, a sealing element 8 and the hub carrier 5 to form a unit which is adjusted only once by the plant and

remains complete when the final drive is disassembled for servicing. ~~On the wheel hub 9~~ A brake disk 15 is placed over connecting elements ~~a brake disk 15~~ on the wheel hub 9 by which the wheel hub 9 can be decelerated. The brake disk 15, which is preferably assembled as a ~~divided arrangement~~ pair of discs fixed together, but can also be assembled as complete brake disk, ~~is~~ in its axial installation position ~~removed~~ is set apart from th sealing element 9 ~~to the extent~~ such that a detrimental increase in temperature ~~impairment~~ of the brake disk 15 does not ~~occur upon~~ afflict the sealing element 9~~, on the wheel hub 9~~ f. Fins 16 are preferably situated ~~with~~ on the wheel hub 9 such that upon rotation of the wheel hub 9 ~~set in motion~~ the medium surrounding the wheel hub 9 is circulated so that the brake disk 15 and the complete final drive are cooled. A bearing 17 which supports the inner central wheel 18 of the second reduction step 11 upon the planet carrier 10 rotates only at the differential rotational speed between the inner central wheel 18 and the planet carrier 10 whereby the service life of the bearing is increased. The bearing 17 can also be constructed ~~by~~ as an axial thrust plate. If the first reduction step 3 and the second reduction step 11 have a helical-cut design, it is possible to ~~lay out~~ design the teeth of the gears so that the bearing 17 ~~be~~ is free of forces. The housing 4 of the drive motor 1 is preferably ~~connected with~~ fixed to an axle bridge 19 but can also be designed ~~with~~ having fastening elements for a single-wheel suspension. The first reduction step 3 and the second reduction step 11 are disposed directly adjacent each other thus being ~~thus~~ surrounded by a common lubricant whereby the lubrication ~~is ensured for~~ lubricates both reduction steps. The wheel bearings 13 ~~is~~ are situated radially further outside the first reduction step 3 and axially in the area of the first reduction step 3 ~~whereby~~. This design creates a very compact final drive ~~can be created~~. ~~By~~ With the wheel bearing 13 being placed radially further outside the first reduction step 3 and ~~a~~ tapered roller bearings being preferably used ~~on O-arrangement~~, a table support of the drive wheel results. The input shaft 2 preferably has a recess 24 on its exterior surface ~~a recess~~ which ~~purposely~~ delivers ~~the~~ lubricant so that the motor bearing 20 remains lubricated. It is also possible to eccentrically ~~to~~ design the opening in which the input shaft 2 is situated

in order to make available sufficient lubrication to the motor bearing 20. The ~~teeth of the~~ reductions gears 3 and 11 have teeth that are preferably helically-cut in order to achieve a favorable noise level. The planets 21 of the second reduction gear 11 are floatingly supported whereby the axial length of the final drive is further reduced.

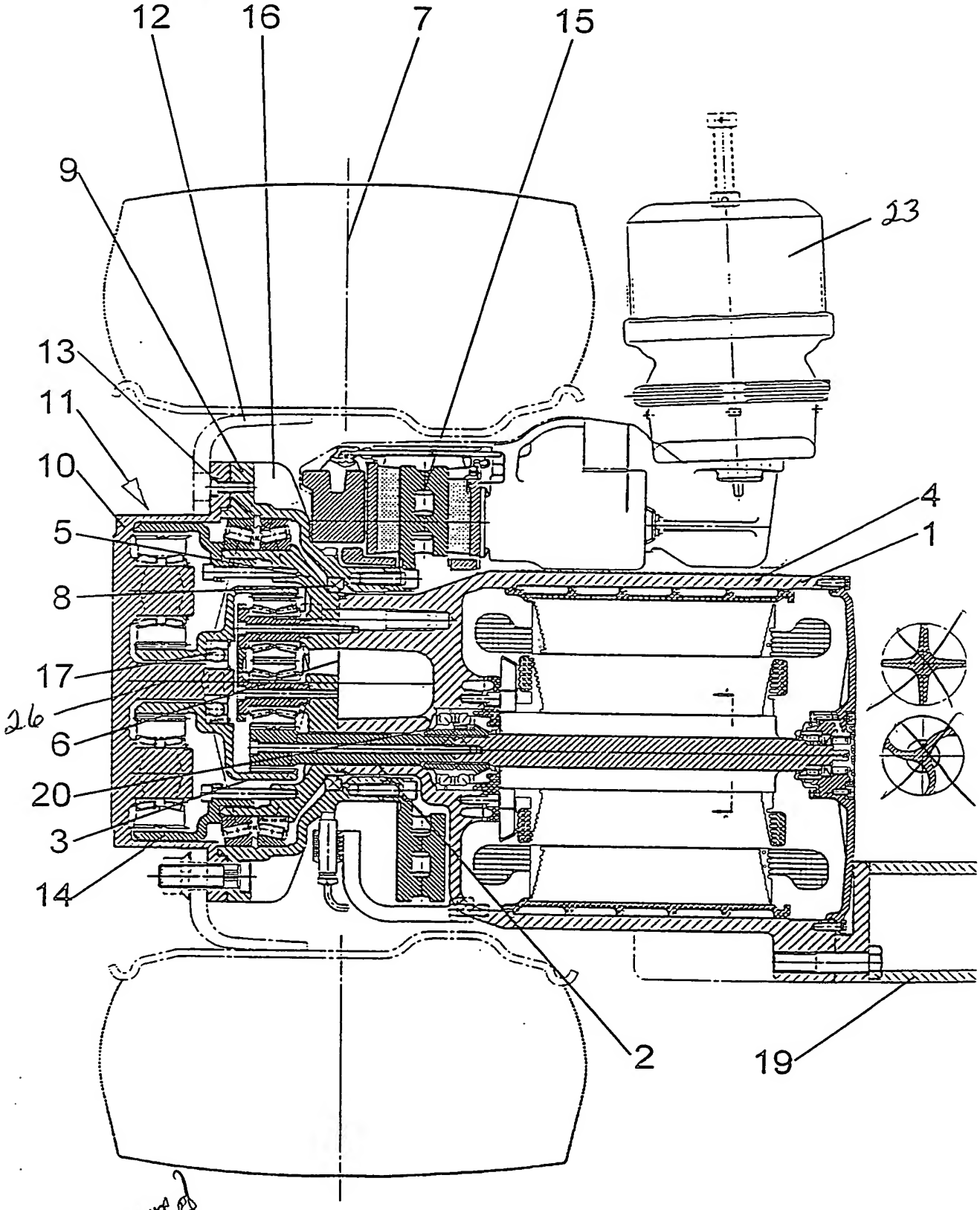
[018] Fig. 2:

A drive motor 1 drives a first reduction step 3, the output of which drives a second reduction step 11 preferably designed as planetary transmission ~~whose~~ with planet gears 21 ~~are double-shear supported~~. The ring gear of the second reduction step 11 can be connected, in a radial direction with the hub carrier 5 either via a screw connection or via safety rings or pins. A rotational speed sensor 22 is placed between the brake disk 15 and the first reduction gear 3. The brake is actuated with an actuation mechanism 23 ~~of the brake~~ which is preferably situated on the side~~, but i~~. It is also possible to actuate the brake via rods extending outside the inner wheel area.

Reference numerals

1 drive motor
2 input shaft
3 first reduction step
4 housing
5 hub carrier
6 mounting pad
7 load active line
8 sealing element
9 wheel hub
10 planet carrier
11 second reduction step
12 wheel rim
13 wheel bearing
14 ring gear
15 brake disk
16 fins
17 bearing
18 inner central wheel
1 9 axle bridge
20 motor bearing
21 planet gears
22 rotational speed sensor
23 actuation mechanism
24 winding recess
26 wheel

Annotated Sheet Showing Changes



Changes approved
12-23-3

Fig. 1

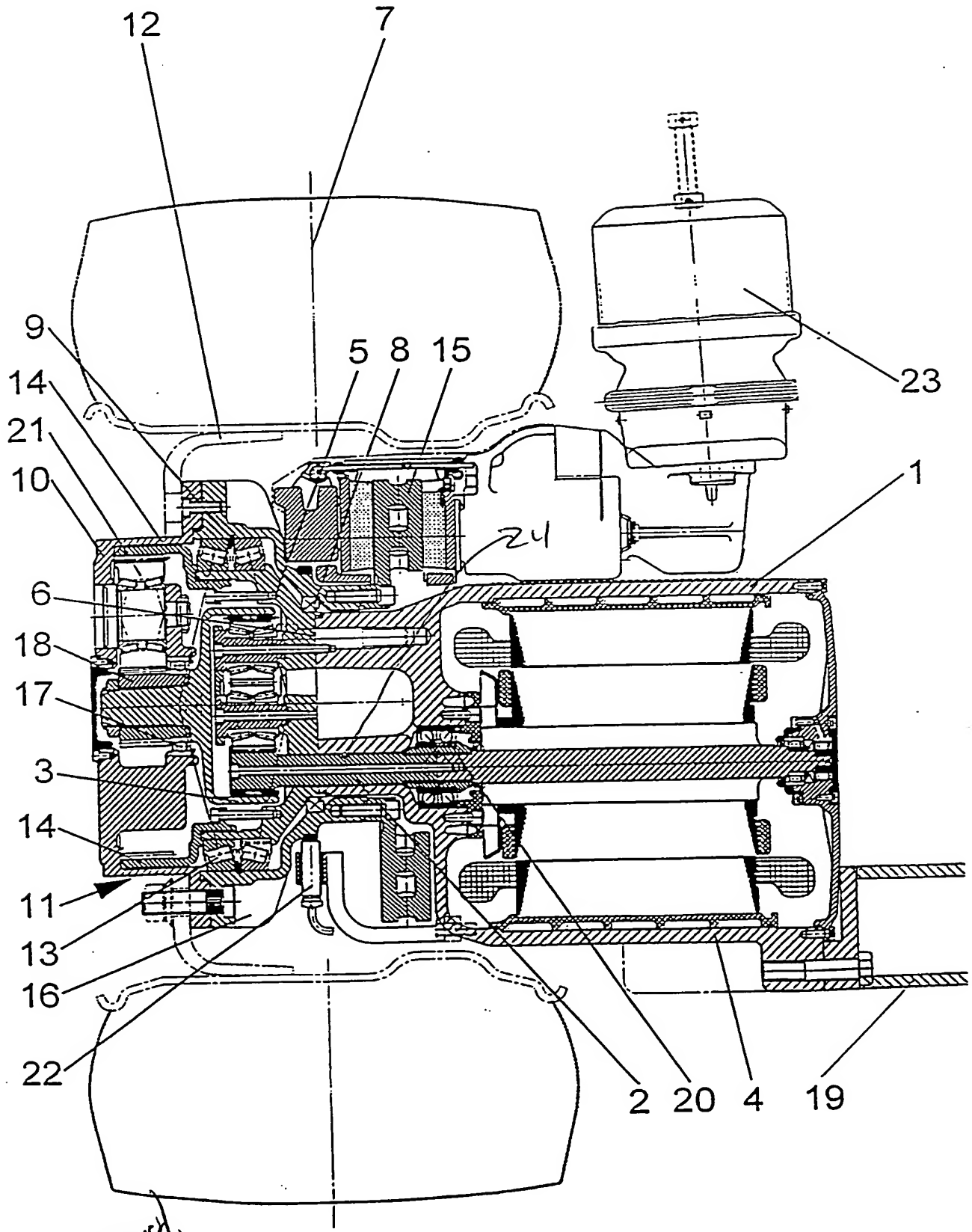


Fig. 2